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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 09/752,685 | 01/03/2001 | Shane J. Trapp | M4065.0369/P369 | 9753 |
| 24998 | 7590 | 08/25/2004 | EXAMINER | |
| DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP 2101 L STREET NW WASHINGTON, DC 20037-1526 | | | | CHEN, JACK S J |
| ART UNIT | | PAPER NUMBER | | |
| | | 2813 | | |

DATE MAILED: 08/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 09/752,685 | TRAPP, SHANE J. | |
| | Examiner | Art Unit | |
| | Jack Chen | 2813 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM
 THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 12 May 2004.
 2a) This action is **FINAL**. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-13, 15-25, 36-39, 41-46 and 64-70 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-13, 15-25, 36-39, 41-46, 64-70 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____. | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____. |

DETAILED ACTION

This Office Action responses to communication dated on May 12, 2004.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1, 3-12, 15-18 and 20-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Ding et al [US 5,814,563].

Notice: This rejection is based on the situation that “consisting essentially of” is construed as equivalent to “comprising”. See MPEP 2111.03, *In re Herz*, 537 F.2d 549, 551-52, 190 USPQ 461, 463 (CCPA 1976) (*emphasis in original*) (Prior art hydraulic fluid required a dispersant which appellants argued was excluded from claims limited to a functional fluid “consisting essentially of” certain components. In finding the claims did not exclude the prior art dispersant, the court noted that appellants’ specification indicated the claimed composition can contain any well-known additive such as a dispersant, and there was no evidence that the presence of a dispersant would materially affect the basic and novel characteristic of the claimed invention. The prior art composition had the same basic and novel characteristic (increased oxidation resistance) as well as additional enhanced detergent and dispersant characteristics.). For the purposes of searching for and applying prior art under 35 U.S.C. 102 and 103, absent a clear indication in the specification or claims of what the basic and novel characteristics actually are, “consisting essentially of” will be construed as equivalent to “comprising.”

➤ With respect to claims 1, 3-4, 8-12 and 15-18, Ding et al, figs 1-7 and col 1-13, discloses a method of forming an opening in an insulating layer (20, fig 1d) formed over a substrate (25,32,34, 36, fig 1d) in a semiconductor device comprising etching said insulative layer with an etchant composition consisting essentially of ammonia (NH₃) and at least one of fluorocarbon (CHF₃ and CF₄) so as to form said opening wherein flow rate ratio of said at least one fluorocarbon to said ammonia is from about 4:1 to about 10:1 and said flow rate of said ammonia is at least about 2 sccm (col 11-12) [claims 1, 9-11 and

15-18]; said etching includes plasma etching [claim 3], is performed through a patterned photoresist mask [claim 8] without forming an etch stop [claim 12], and is performed at a temperature range of about -50 to about 80°C (see examples) [claim 4]. Regarding the flow rate of ammonia (2 sccm to about 6 sccm), see fig. 4 (Ding et al.), which is within the scope of the instant invention, also see col. 8, lines 1-3 and col. 10, lines 25-40.

- With respect to claim 5, Ding et al discloses the etching is performed within a range temperature of about 0-50°C (e.g. 50°C, col 6 lines 51-67).
- With respect to claims 6-7, Ding et al discloses the etching is performed at an operating pressure of about 40-50 mTorr (e.g. 50 mTorr, col 5 lines 45-65).
- With respect to claims 20-21, Ding et al discloses the etching is performed at the flow rate of CF₄ of about 15-20 sccm (e.g 18 sccm, col 10 lines 31-33).
- With respect to claims 22-23, Ding et al discloses the etching is performed at the flow rate of CHF₃ of about 35-45 sccm (e.g. 40 sccm, col 10 lines 24-26).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1-13, 15-25, 36-39, 41-46 and 64-70, as being best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Tan et al [US 6,140,168] in view of Ding et al [US 5,814,563].**

Tan et al, figs 1's and col 1-4, discloses a method for forming a self-aligned contact opening (124, fig 1D) in an insulative layer (114b) formed over a substrate comprising steps:

providing the substrate (100, fig 1A) comprising adjacent gate stacks being formed thereon, the adjacent gates stacks comprising opposed side wall spacers (108) which have been formed over the adjacent gate stacks [*claims 13, 36, 64*] ;

forming the insulative layer (114, fig 1B) over the substrate, the adjacent gate stacks and the side wall spacers which have been formed over the adjacent gate stacks [*claims 13, 36 and 64*] ;

forming a patterned photoresist mask layer (116, fig 1B) over said insulative layer [*claims 8 and 36*] ;

contacting and etching the insulative layer through an aperture (120, fig 1C-1D) in the patterned photoresist mask layer using a plasma etchant mixture [*claim 3*] comprising fluorocarbon (CHF₃ and CF₄, col 3 lines 42-55) [*claims 9-11, 18, 36, 66*] so as to form the self-aligned contact opening (124, fig 1D) without an etch stop [*claims 12, 42, 64*] in the insulative layer located between the adjacent gate stacks and the opposed side wall spacers aligning the self-aligned contact opening to the substrate [*claims 2, 13, 43*], wherein said sidewall spacers are not etched and defines at least in part of said self-aligned contact opening (fig 1D) [*claims 13 and 64*] ;

removing the patterned photoresist mask layer after said contacting and etching [*claim 46*].

- With respect to claims 1-4, 8-13, 18, 36-39, 42-44, 46, 64, 66 and 69, Tan et al does not teach: 1) using the plasma etchant mixture essentially consisting of ammonia

and said fluorocarbon of a ratio flow rate of the fluorocarbon to ammonia of 2:1 to 40:1 with the flow rate of said ammonia of at least about 2 sccm to form the self-aligned contact opening at a temperature of about -50 to 80°C with further forming a protective layer over the opposed side wall spacers of the adjacent gate stacks; and 2) depositing a conductive plug inside said self-aligned contact such that said conductive plug is separated from said side opposed side wall spacers by said protective layer.

Regarding to 1), Ding et al teaches using ammonia in addition to fluorocarbon with the flow rate ratio of the fluorocarbon to ammonia of 2:1 to 40:1 and the flow rate of ammonia of at least about 2 sccm for plasma etching the insulative layer at a temperature of about -50 to 80°C would provide a better etch process with a high etch rate and an improved etch selectivity (see col 5-12). Ding et al also teaches using the plasma etchant mixture consisting essentially fluorocarbon and ammonia would form an opening with a protective layer being formed on sidewall of the opening (fig 1b or 1d). Therefore, it would have been obvious for those skilled in the art to modify the process of Tan et al by using the plasma etchant mixture essentially consisting of ammonia and said fluorocarbon with the flow rate ratio and temperature as being claimed, per taught by Ding et al, to etch the self-aligned contact with a better etch rate and improved etch selectivity without an etch stop. In addition, those skilled in the art would recognize that combination of the process of Tan et al in view of Ding et al will form a protective layer containing nitrogen over the opposed side wall spacers in the self-aligned contact opening.

Regarding to 2), depositing the conductive plug inside the self-aligned contact opening is known in the art for forming electrical connection in a semiconductor device. In

addition, Tan et al teaches forming a self-aligned contact opening is for forming electrical connection between source/drain region and metal layer [see col 2 lines 15-23]. It would have been obvious for those skilled in the art to modify the process of Tan et al in view of Ding et al by depositing the conductive plug inside the self-aligned contact opening wherein the conductive plug separated from the sidewall spacers by the protective layer since the usage of the plasma etchant mixture consisting essentially of ammonia (NH₃) and at least one of fluorocarbon to provide electrical connection between source/drain region to certain location of the semiconductor device to operate the device.

► With respect to claim 19, Tan et al (col 3 lines 42-50) teaches using the fluorocarbons essentially consisting of CF₄ and CHF₃ for etching the insulative layer. Ding et al teaches C₂H₂F₂ can be added to the fluorocarbon mixture for etching the insulative layer. Therefore, it would have been obvious for those skill in the art to use the fluorocarbon mixture comprising CF₄, CHF₃, and CH₂F₂ to etch the insulative layer in the process of Tan et al in view of Ding et al. In addition, using the fluorocarbons comprising CF₄, CHF₃ and CH₂F₂ has been known in the art for etching the insulative layer. The selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in Sinclair & Carroll Co., Inc. v. Interchemical Corp. , 325 U.S. 327, 65 USPQ 297 (1945). "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

► With respect to claims 1, 4-7, 15-17, 20-25, 36, 39, 41, 44-45, 64-70, claimed ranges of temperature, flow rates, flow rate ratios in the etching step and thickness, absent evidence of disclosure of criticality for the range giving unexpected results are

considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious. See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Response to Arguments

Applicant's arguments filed May 12, 2004 have been fully considered but they are not persuasive.

Applicant argues that the prior art (Ding et al.) does not teach the flow rate of ammonia is in the range of about 2 to 6 sccm. The examiner disagrees because fig. 4; col. 8, lines 1-3 and col. 10, lines 25-40 show this feature (i.e., 3sccm).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, using the etching chemistry as taught by Ding et al. would provide a better etching selectivities and provide self-aligned contact hole.

With respect to the thickness of the protective layer, it is noted that the specification does not disclose anything critical regarding this particular thickness; therefore, this particular range is considered as routine optimization.

Conclusion

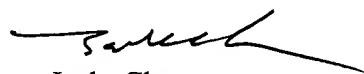
THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Chen whose telephone number is (571)272-1689. The examiner can normally be reached on Monday-Friday (9:00am-6:30pm) alternate Monday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W Whitehead can be reached on (571)272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jack Chen
Primary Examiner
Art Unit 2813